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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/700,386	11/03/2003	Leonid Grigorian	23085-08567	5816
45380	7590	12/12/2007		
HONDA/FENWICK SILICON VALLEY CENTER 801 CALIFORNIA STREET MOUNTAIN VIEW, CA 94041			EXAMINER STOUFFER, KELLY M	
			ART UNIT 1792	PAPER NUMBER
			MAIL DATE 12/12/2007	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/700,386

Applicant(s)

GRIGORIAN ET AL.

Examiner

Kelly Stouffer

Art Unit

1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 31 May 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) 22-25 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 November 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Election/Restrictions***

Applicant's election without traverse of claims 1-21 in the reply filed on 31 May 2007 is acknowledged.

### ***Drawings***

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: reference character 3 in Figure 2. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

***Specification***

The disclosure is objected to because of the following informalities: on page 10 lines 6-7 "page 2 paragraph 7" should be --page 3 paragraph 8--.

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation "said catalyst". There is insufficient antecedent basis for this limitation in the claim.

Claim 3 recites the limitation "the catalyst". There is insufficient antecedent basis for this limitation in the claim.

Claim 9 recites the limitation "said membrane". There is insufficient antecedent basis for this limitation in the claim.

Claim 11 recites the limitation "said catalyst". There is insufficient antecedent basis for this limitation in the claim.

Claim 16 is rendered indefinite and confusing because it only consists of a preamble without any actual claim limitations.

Claim 17 recites the limitations "the ratio of" (several times in different instances) and "said catalyst composition" (several times in different instances). There is insufficient antecedent basis for these limitations in the claim.

Claim 18 recites the limitation "said catalyst". There is insufficient antecedent basis for this limitation in the claim.

Claim 19 recites the limitation "said inert gas". There is insufficient antecedent basis for this limitation in the claim.

Claim 20 recites the limitation "said carbon-containing gas" (several times in different instances). There is insufficient antecedent basis for this limitation in the claim.

Claim 21 recites the limitation "said carbon-containing gas". There is insufficient antecedent basis for this limitation in the claim.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 16 and 19 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Kong et al. (Chem. Phys. Lett. 292 (1998) 567-574).

Kong et al. discloses a chemical vapor deposition process for producing single-wall nanotubes (title) using argon (see Experimental section p 569).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Che et al. (Chem. Mater. 1998, 10, 260-267) in view of Kong et al.

As to claims 1 and 16, Che et al. discloses a CVD process for producing carbon nanotubes (title) comprising contacting a carbon containing gas with a porous membrane with two sides, wherein the first side is opposite the second side and where a thin catalyst layer is present on at least one side of the membrane. The carbon gas is decomposed in the presence of a catalyst at a sufficient temperature to grow carbon nanotubes. See the Experimental Methods section on page 261. Though Che et al. does not explicitly teach single walled carbon nanotubes, it is implied by the reference as dependant upon deposition time on page 262, column 1. Kong et al. further supports this conclusion in the discussion section on page 571 and further cites using methane to help reduce amorphous carbon. Also, though Che et al. does not explicitly teach a greater pressure on the first side of the membrane as opposed to the second, one of ordinary skill in the art would realize that because the flow of deposition gases is contacting the first side the gas flow (and, hence, pressure) will be less on the second side as the gas flow either has to flow through pores or around the substrate to reach the second side, especially when given specifics of a suitable CVD apparatus taught by Kong et al. (see Experimental section p 569) with the process gas head pressure of 1.25 atm.

As to claims 2 and 3, Che et al. discovered that the carbon nanotubes are produced by the catalyst particles (column 2 page 262). Therefore, if there are catalyst particles on the second side of the membrane, or between the catalyst and the first side of the membrane (as the Experimental section of Che et al. suggests) there will also be nanotube growth on the second side and between the catalyst and the first side of the

porous membrane. Further, nanotube growth predominantly in the pores can be further broadly interpreted for either of these limitations.

As to claim 4, Kong et al. teaches using a catalyst only on the front side of a support, or substrate, which is analogous to that of Che et al.

As to claim 5, Kong et al. teaches that using methane gas is preferred because it is the most kinetically stable hydrocarbon, undergoes the least pyrolytic deposition, and facilitates the formation of single walled carbon nanotubes.

As to claims 6, 7 and 19, Kong et al. uses methane and argon (see Experimental section p 569). Che et al. teaches the utility of hydrogen in such a mixture is to grow nanotubes out of the pores and over the membrane surface in column 2 page 262.

As to claims 8-10, the porous membranes of Che et al. are alumina with a pore size of 200 nm (Materials section on page 261).

As to claims 11-12, Kong et al. teaches a molybdenum catalyst (column 2 p 567) and a mixture of iron and aluminum catalysts (abstract) suitable for single walled carbon nanotube growth. All the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded predictable results to one of ordinary skill in the art at the time of the invention. See *KSR International Co. v. Teleflex Inc.* 550 U.S.--, 82 USPQ2d 1385 (2007).

As to claim 13, both Che et al. and Kong et al. teach sufficient temperatures for decomposition of the gas on a catalyst to form CNTs (see each reference's experimental section). It is obvious to one of ordinary skill in the art that this



temperature is going to depend upon which precursor used and which catalysts are used in the invention. It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the temperatures within the claimed range, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

As to claims 14-15, Kong et al. claims a 1.25 atm head pressure, or over 900 torr pressure, on the first side of the substrate analogous to Che et al.'s membrane. One of ordinary skill in the art would realize that the flow dynamics reaching the second side of the membrane would depend upon membrane pore size, membrane size, membrane thickness, and other physical diameters. Therefore, the pressure on the second side of the membrane, and hence the pressure differential may be modified according to the experimental apparatus. It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the pressure differentials within the claimed ranges, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

As to claims 20-21, argon flow in Che et al. is modified to stabilize pressure (column 1 page 261), the flow of hydrogen effects the growth of the nanotubes on the membrane in Che et al. page 260 column 1, and the flow of methane will effect the growth rate and time of exposure and growth of CNTs (also whether the CNTs will be single walled or not as discussed above.) Therefore, it would have been obvious to a

person having ordinary skill in the art at the time the invention was made to modify the ratios of gases within the claimed ranges to achieve the above results, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

### ***Allowable Subject Matter***

Claims 17-18 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims. While the references provide the mix of catalysts as discussed above, there is no motivation provided for changing their concentrations within the catalyst composition.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kelly Stouffer whose telephone number is (571) 272-2668. The examiner can normally be reached on Monday - Thursday 7:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.


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Kelly Stouffer  
Examiner  
Art Unit 1792

kms



**TIMOTHY MEEKS**  
**SUPERVISORY PATENT EXAMINER**